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ABSTRACT

The popular media extensively covered Benbow and Stanley's (1980) reported finding of a major sex difference in mathematical reasoning abilities among gifted seventh-grade students. The purpose of this study was to assess the impact of that media campaign on parents' beliefs regarding their sons' and daughters' math aptitudes. Two sets of parental beliefs were studied: (1) parents' beliefs about the mathematical abilities of their own children, and (2) parents' general stereotypes about sex differences in mathematical ability. A sample of predominantly middle-class parents had responded to questionnaires in the spring of 1979 and 1980. Approximately 3 months after the media campaign, a third questionnaire was sent to a subsample of 250 parents with children in the seventh, ninth, and eleventh grades. Included in the survey was a question describing the media coverage of the research and asking whether the respondent had heard about it. Approximately one-quarter of the parents were aware of the study. Results indicated that exposure to the media reports of the Benbow and Stanley study did affect parents' attitudes. As predicted, exposure had its largest impact on mothers of daughters and fathers of sons. Both became more stereotyped in their beliefs. Unexpectedly, media exposure also had a positive effect on fathers of daughters; whereas the attitudes of fathers unexposed to the media campaign became more sex stereotyped than before, fathers exposed to the campaign thought their daughters had slightly more ability than they had previously believed. (RH)

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Science and the Media:

Benbow and Stanley Revisited

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Abstract

The impact of the media coverage of the Benbow and Stanley 1980 Science article on parents' beliefs was tested. Parents' beliefs regarding both their children's math ability and regarding general sex differences in math ability and in the utility of enrolling in advanced math courses were assessed. 224 parents, who had provided their beliefs on surveys in 1978 and 1979, were recontacted and their beliefs were reassessed. Both the mothers of daughters and the fathers of sons had developed more sex-stereotyped attitudes after exposure and in comparison to parents who had not been exposed to the media campaign.

News is the word we use for the information which people receive second-hand about worlds which are not available to their own experience (1). Out of a vast number of occurrences, only a few events are considered important enough to become news. The information generated by social science researchers is seldom considered newsworthy. However, once in a while the media cover a research report in some detail. Such an event occurred shortly after the release of an article in Science by Benbow & Stanley (2), reporting a major sex difference in the mathematical reasoning ability among gifted 7th grade students.

The popular media coverage of this research report was extensive, including headlines such as "Do Males Have a Math Gene?" (3) and "The Gender Factor in Math: A New Study Says Males May Be Naturally Abler than Females" (4) The text of the articles often implied that the sex difference was due to inherited or other biological factors. For example, Family Weekly (5) reported that the study "concludes that boys are born with greater math ability" An article in Time magazine (4) summarized the original report thus: "males inherently have more mathematical ability than females." Althouth criticism regarding the scientific rigor of the study and questions regarding the authors' conclusions from the data appeared shortly after the initial article, the media did not provide comparable coverage of these alternate views until much later. This paper evaluates the impact of the media campaign on parents' beliefs regarding their sons' and daughters' math aptitudes.

In recent years the idea that the media has a strong influence in changing public opinion and affecting policy has been accepted by

scholars, policy makers, and media leaders (6). People believe what they are exposed to in the mass media because the media is assumed to be objective. People read newspapers and magazines, and listen to radio and television broadcasts in order to find out about the objective state of the world. However, the media does not simply bring the world to us; it selects what to report and what to ignore (7). In the case of social science reporting, reporters who are responsible for science or education news must be relied upon as ambassadors to the lay world for the specialties they cover. Although they are expected to ask and report the important questions, they typically are working against very tight deadlines. This pressure can result in the publication of findings in which "critical scrutiny of the quality of the evidence is subordinated to a forceful presentation of simplified conclusions" (8). Futhermore reporters often over-emphasize dramatic conclusions, rather than pointing out the problems or unresolved issues.

Because the media determines what picture of the world we see, many of us think that it must have a powerful effect on the beliefs of individuals and communities. However, there is little evidence to support this hypothesis. Recently, researchers have studied media treatment of social science reports such as the Coleman Report (8). However, the impact of such reports on the beliefs of the public has not been studied, primarily because base-line data gathered before the media event is rarely available. Social scientists have had to be content with post-hoc field studies unless circumstances provided for the base-line data. Such an opportunity arose with news coverage of Benbow and Stanley's Science report: a longitudinal study of parental

influences on achievement expectancies was underway, providing a unique opportunity to evaluate the impact of media coverage using a pre/post quasi-experimental design.

If media coverage of psychological research affects readers' attitudes, then this media campaign should have created measurable changes in parents' beliefs regarding sex differences in math aptitude. Futhermore, social psychological theories of schema-related information processing predict that the content and centrality of an individual's existing beliefs influence the comprehension of new information. Therefore, the centrality of parents' beliefs regarding the relationship of sex to math aptitude should influence the extent to which they incorporated the media's message into their belief system. Both one's own sex and the sex of one's child should affect the centrality of one's belief system in this domain. Since mothers and fathers have sex-stereotyped beliefs regarding both their own math aptitudes and their children's (10), sex-stereotyped media information should reinforce these beliefs and encourage them to generalize their self-perceptions to their same-sex child. Consequently, mothers of daughters and fathers of sons should incorporate the media's sex-stereotyped message into their beliefs to a greater extent than other parents. The present study tests these hypotheses. Two sets of parental beliefs were studied: (1) parents' beliefs about the mathematical ability of their own children and (2) parents' general stereotypes about sex differences in mathematical ability. A sample of predominantly middle-class parents living in a suburb of Detroit had responded to questionnaires in the spring of 1979 and 1980. Approximately three months after the major media campaign, a third

questionnaire was sent to a subsample of 250 parents with children in the 7th, 9th, and 11th grades. Ninety percent (114 mothers and 110 fathers) returned the questionnaire.

Questionnaires contained Likert-scaled items and open-ended questions tapping parents' beliefs regarding their children's math aptitude, the importance for their children of taking advanced mathematics courses, as well as other high school courses, and their stereotypes regarding both sex differences in math ability and the utility of math for males and females. Parents' perceptions of their children's math ability were assessed by items related to the effort necessary to succeed at math, the perceived difficulty of math for their children, and expectancies for their children's future success in math. These questions were identical to questions asked in the two previous waves. In addition, the last page of the survey contained a question which described the media coverage of the research and asked if the respondent had heard about it. Approximately one quarter of the parents (N=57) had. Of these people, 68% had seen a magazine article about it, 18% had read about it in the newspaper, and smaller numbers had heard about it on the radio, television, or from a friend. Many people indicated that they had heard about the report from several sources.

The beliefs of those who had heard about the Benbow and Stanley report from the media were compared with those who had not. For the sake of clarity, we will refer to those who heard about the report as the "misinformed" group and those who did not as the "uninformed" group. Analyses of variance performed on all pretest variables and on indicators of socioeconomic class indicated that misinformed and

uninformed parents did not differ in their beliefs, or their status prior to media exposure.

The impact of media exposure was tested with univariate and multivariate analyses of covariance using the data from the 1979 and 1980 waves as the covariates. Mothers' and fathers' responses for sons and daughters were analyzed separately. Univariate analyses are summarized in Table 1; multivariate and simple effects analyses are summarized below.

Perceptions of Child's Math Ability

Mothers. Compared to other mothers, misinformed mothers of daughters appeared to think that their daughters had less math ability, were less likely to succeed in math in the future, found math more difficult, and had to work harder to succeed in math. To test this, a multi-variate analysis of covariance was performed using the responses to the first and second year's questionnaires as covariates and these four ability ratings as the dependent variables. There was a significant interaction between sex of child and awareness of the media coverage, $F(4,92) = 2.63$, $p<.05$. Misinformed mothers of daughters beliefs about their daughters' abilities declined compared to misinformed mothers of sons or uninformed mothers. This was particularly true for questions concerning the perceived difficulty of math for the child. A univariate analysis of covariance for a scale containing items about perceived difficulty yielded a main effect for sex and a significant interaction of sex and awareness (See Table 1). Misinformed mothers of daughters rated math as much more difficult for their daughters than both misinformed mothers of boys ($F(1,101)=12.3$, $p<.001$) and uninformed mothers of girls ($F(1,101)=6.8$, $p<.01$).

Fathers. When fathers' attitudes about the same issue were examined, an unexpected overall trend was found (see Table 1). Generally, fathers of girls felt that their daughters had slightly less ability than fathers of sons. However, misinformed fathers of girls changed their beliefs in the direction of thinking their daughters had slightly more ability after hearing the media coverage, while uninformed fathers changed in the opposite direction. The uninformed fathers' beliefs had become more sex stereotyped. If they had girls they believed their daughters had less ability by the time of the post test. This pattern was apparent for all of the ability related questions, although the differences between the groups were not always significant and the multi-variate analysis of covariance did not yield significant main effects.

Summary. Although differences were not always found between the misinformed and uninformed groups, a striking overall pattern did emerge. The misinformed group appeared to change slightly more than the uninformed group, with misinformed fathers' views becoming more similar for girls and boys, while misinformed mothers' responses became more differentiated depending on the sex of their child. In other words, misinformed mothers of girls became more conscious of sex differences after hearing about the research findings and misinformed fathers became more egalitarian. The sentiment of misinformed mothers is captured in open-ended responses from mothers of daughters: "Boys have a tendency to understand the principles (of math) but girls are trying to just memorize the principles; and boys and girls have "basic, but slight, differences between inherited abilities."

Projections into the Future

When asked about their expectations for their child's performance in future math classes, misinformed mothers and uninformed mothers did not differ for either sons or daughters. However, exposure to media coverage had a large effect on the expectations fathers held for their children's future success in math. Misinformed fathers of both girls and boys thought that their children would perform better in future math courses than uninformed fathers ($F(1,93)=7.0, p<.01$). Hearing about the research seemed to make future math success more salient to fathers of daughters. When misinformed and uninformed fathers of girls were compared, misinformed fathers thought that their daughters would do much better in advanced math courses than uninformed fathers of girls ($F(1,93)=4.2, p<.05$). The same general trend was apparent when fathers were asked to rate the importance of the following courses for their children: algebra, biology, English literature, and calculus. While few group differences were found, misinformed fathers rated calculus and trigonometry (listed together on the questionnaire) as more important for both their sons and daughters than did uninformed fathers [$F(1,93)=5.7$, $p<.05$]. This represented change from the first two years of the study when we found a that fathers of sons felt that calculus and trigonometry were much more important for their child than fathers of daughters (11). After hearing about the media coverage, misinformed fathers of girls increased the importance they attached to calculus for their daughters while fathers of sons did not change their ratings of its importance.

General Sex-based Stereotypes

Mothers. Parents were asked general stereotype questions about

how useful males and females find math in their adult lives and who does better in advanced math classes. All mothers rated math as more useful for males than for females; there were no differences between the groups or by sex of child. A similar effect emerged on the sex-stereotyping of math ability question. When asked directly, "Who does better in advanced math classes?" all mothers said that males do slightly better than females; neither sex of child nor media exposure had a significant effect.

Fathers. When fathers were asked about the future utility of math, more differences emerged. While all fathers thought that math was more useful for males than females, fathers of sons thought that math was more useful for males in general than fathers of daughters, ($F(1,107)=9.05, p<.01$). The significant interaction of awareness of the media coverage and sex of child ($F(1,107)=5.26, p<.05$) indicated that misinformed fathers of sons stand out as thinking that math is much more important for males than for females (see Table 1). It appears that media exposure confirmed the gender stereotyped attitudes of fathers of sons, but had little effect on the stereotyped beliefs of mothers. Knowledge of the media coverage coupled with having sons seemed to confirm and strengthen the fathers' stereotyped views that math is more useful for males.

A similar pattern emerged for the sex stereotype of math ability question. While most fathers thought that males do slightly better than females in advanced math classes, there was a clear difference between misinformed and uninformed fathers. Misinformed fathers endorsed the stereotype that males do better than females more strongly than uninformed fathers ($F(1,107)=16.24, p<.001$). In

addition, misinformed fathers of sons endorsed the stereotype that males do better than females in advanced math classes more strongly than any other group.

Conclusions

Generally speaking, exposure to the media reports of the Benbow and Stanley study did affect parents' attitudes. As predicted, exposure had its largest impact on mothers of daughters and fathers of sons. Both became more stereotyped in their beliefs. But, unexpectedly, media exposure also had a positive effect on fathers of daughters; these fathers came to the defense of their daughters. Why should the media have such a different effect on mothers and fathers of daughters? The answer, we believe, lies in the centrality and content of the parents' existing beliefs as well as the appropiateness of generalizing from one's own experience and self-perception to one's child. In the two pre-exposure waves, mothers of sons almost always had a more positive evaluation of their child's math ability than mothers of daughters, while the evaluation of fathers of sons and daughters did not differ substantially. The mothers also had a much more negative view of their own math ability than did the fathers. Finally, there was a stronger relationship between mothers of daughters' self perceptions and their evaluations of their child's math ability than any other parent-child combination (11). Apparently, mothers see themselves more negatively and are more prone to project this image onto their daughters than are fathers. Given this pattern, one would expect that exposure to the stereotyped media information would confirm these mothers' self-image and legitimize projecting it onto their daughters. In contrast, the fathers neither

had a negative self-image nor did they, as a group, judge daughters to be less math-able than sons. Therefore, they had little reason to incorporate the media reports into their image of their own daughters. Instead, exposure to the media seemed to sensitize these fathers to the importance of math, bringing them to the defense of their daughter's capabilities.

Fathers of sons responded somewhat differently. They did not raise their evaluations of their sons since these were already fairly high. Instead, they became more convinced than their uninformed counterparts of general sex-role stereotypes. Exposure to the media reports also increased the sex role stereotyping of fathers of daughters, but to a lesser extent than it did for fathers of sons. These results suggest that one of the major effects of the popular coverage of the research report was that it changed the "social desirability" climate. Before the media coverage, it was popular to espouse a belief in equal math abilities of males and females. After the media coverage it was "okay" to say that males are better than females in math.

These findings are not surprising. We know that the salience of an event determines how we interpret and remember it. We would expect parents with math-able daughters to interpret the news of superior male mathematical ability much differently than parents with sons, and mothers to interpret it differently than fathers. According to media experts, individuals' first-hand experiences are weighed against the "objectivity assumption" discussed earlier. Media absorption involves a self-selection according to previous attitude (12). In this case, it appears that hearing about the report may have had the effect of

confirming mothers' beliefs that their daughters are not as able in math as their sons, while it put fathers of girls in a position of challenging the "evidence" for their daughters. The opposite happened in the case of general stereotypes for math. Fathers of sons had their beliefs confirmed, while mothers did not.

Despite the fact that parents in general held stereotyped beliefs, many parents of daughters spoke of the need to change stereotypic views of women and mathematics. One mother summed up the position succinctly when she said, "For whatever reason, boys in general seem to pick up math concepts with more ease and less methodical study. There are exceptions, however, and I would not want my daughter to feel she could not do equally well in math as her brothers." She went on to say, "Perhaps society has encouraged boys in math more than girls. I hope it is changing." So do we. But, unfortunately, media effects such as those reported in this paper will not facilitate this change.

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Table 1

Adjusted Mean Differences (Analysis of Covariance)

Mothers[1]	Misinformed Daughters	Misinformed Sons	Uninformed Daughters	Uninformed Sons	F-Ratios Group Effect	Sex of Child Effect	Group x Sex Effect
Perception of Task Difficulty for Child[a]	4.5	3.2	3.8	3.6	.39	11.32***	8.01**
Future Expectancy in Math for Child[b]	5.1	5.6	5.2	5.2	.36	2.02	1.06
Importance of Trigonometry/ Calculus for child[c]	5.1	5.3	4.7	4.9	2.63	.58	.30
Future utility of math for females vs. males[d]	2.2	2.3	2.4	2.4	.37	..16	.07
Who does better in advanced math classes--females vs. males[e]	3.6	3.5	3.3	3.4	1.50	..01	1.03
Fathers							
Perception of Task Difficulty for Child[a]	4.0	3.8	4.2	3.9	.60	1.70	.10
Future Expectancy in Math for Child[b]	5.4	5.6	4.7	5.2	6.98**	2.42	.33
Importance of Trigonometry/ Calculus for child[c]	5.7	5.7	4.9	5.3	5.71*	.39	..88
Future utility of math for females vs. males[d]	2.1	1.3	1.9	1.8	1.46	9.05**	5.26*
Who does better in advanced math classes--females vs. males[e]	3.6	4.4	3.3	3.5	16.24***	9.06**	4.94*

* $p < .05$
** $p < .01$
*** $p < .001$

[a] 1 = very easy, 7 = very hard

[b] 1 = not well, 7 = very well

[c] 1 = not important, 7 = very important

[d] 1 = males, 5 = females

[e] 1 = females, 5 = males

[1] Significant results of MANOVA are reported in text.